

We claim:

1. A transgenic organism expressing a transgene encoding an enzyme having the catalytic activity of 3-hydroxyacyl-ACP thioesterase.
2. The organism of claim 1 further comprising one or more transgenes encoding enzymes having the catalytic activity of acyl-CoA synthetase or acyl CoA transferase.
3. The organism of claim 2 wherein the acyl-CoA synthetase is 3-hydroxyacyl-CoA synthetase.
4. The organism of claim 2 wherein the acyl-CoA synthetase is *alkK*.
5. The organism of claim 2 or 3 further expressing a PHA synthase.
6. The organism of claim 1 or 5 further expressing a heterologous 3-hydroxyacyl-CoA synthetase activity.
7. The organism of claim 1 wherein the enzyme is modified.
8. The organism of claim 5 expressing an enzyme selected from the group consisting of 3-hydroxyacyl-ACP thioesterase, medium chain length PHA synthase, and medium chain length 3-hydroxy fatty acid acyl CoA synthase, wherein the organism is a plant cell, plant tissue, or whole plant.
9. The organism of claim 8 further expressing selectable marker genes, wherein the organism is a whole plant.
10. The organism of claim 5 expressing an enzyme selected from the group consisting of 3-hydroxyacyl-ACP thioesterase, a PHA synthase that incorporates medium chain length hydroxy acids, and medium chain length 3-hydroxy fatty acid acyl CoA synthetase, wherein the organism is a bacteria.
11. The organism of claim 8 wherein expression of the transgene is targeted to a tissue or organelle selected from the group consisting of seeds, leaf, plastids, and peroxisomes.
12. The organism of claim 10 wherein the bacteria is *E. coli* and PHA accumulates within the bacteria.

13. A method of engineering a PHA biosynthetic pathway in a transgenic organism comprising providing a construct comprising a transgene encoding an enzyme having the catalytic activity of 3-hydroxyacyl-ACP thioesterase, and making the organism.
14. The method of claim 13 wherein the construct further comprises one or more transgenes encoding enzymes having the catalytic activity of acyl-CoA synthetase or acyl CoA transferase.
15. The method of claim 14 wherein the enzymes have the catalytic activity of 3-hydroxy acyl-CoA synthetase.
16. The method of claim 15 wherein the construct further comprises a transgene encoding a PHA synthase.
17. The method of claim 16 wherein the organism is a plant.
18. The method of claim 16 wherein the construct expresses an enzyme selected from the group consisting of 3-hydroxyacyl-ACP thioesterase, medium chain length PHA synthase, and medium chain length 3-hydroxy fatty acid acyl CoA synthase, wherein the organism is a plant cell, plant tissue, or whole plant.
19. The method of claim 16 wherein the construct expresses an enzyme selected from the group consisting of 3-hydroxyacyl-ACP thioesterase, a PHA synthase that incorporates medium chain length hydroxy acids, and medium chain length 3-hydroxy fatty acid acyl CoA synthetase, wherein the organism is a bacteria.
20. A method of making PHA comprising growing a transgenic organism expressing a transgene encoding an enzyme having the catalytic activity of 3-hydroxyacyl-ACP thioesterase.
21. The method of claim 20 wherein the organism further comprising one or more transgenes encoding enzymes having the catalytic activity of acyl-CoA synthetase or acyl CoA transferase.
22. The method of claim 21 wherein the acyl-CoA synthetase is 3-hydroxyacyl-CoA synthetase.

23. The method of claim 21 wherein the organism further express a PHA synthase.
24. The method of claim 22 wherein the organism further express a PHA synthase.
25. The method of claim 24 wherein the organism expresses an enzyme selected from the group consisting of 3-hydroxyacyl-ACP thioesterase, medium chain length PHA synthase, and medium chain length 3-hydroxy fatty acid acyl CoA synthase, wherein the organism is a plant cell, plant tissue, or whole plant.
26. The method of claim 24 wherein the organism expresses an enzyme selected from the group consisting of 3-hydroxyacyl-ACP thioesterase, a PHA synthase that incorporates medium chain length hydroxy acids, and medium chain length 3-hydroxy fatty acid acyl CoA synthetase, wherein the organism is a bacteria.
27. A method of screening for enzymes encoding 3-hydroxy acyl ACP thioesterase activities comprising:
- a) coexpressing an enzyme in a heterologous organism that expresses a PHA synthase and a 3-hydroxyacyl-CoA synthetase or a CoA transferase, and
  - b) growing the organism under appropriate conditions for the production of a PHA.
28. A method for increasing the levels of C8 and C10 hydroxyacids or fatty acids of a plant oil composition comprising
- a) expressing a transgene encoding an enzyme having the catalytic activity of 3-hydroxyacyl-ACP thioesterase, and
  - b) growing the plant under appropriate conditions for the production of the plant oil composition.
29. The organism of claim 10 wherein the bacteria is *E. coli*, and wherein 3-hydroxy acids are secreted into the culture medium.